CLAIMS

1. A method for resolving cell placement overlaps in an integrated circuit comprising the steps of:

     a) determining an initial placement of the cells;

     b) capturing a view of the placement including blockage-space and free-space to define in an image space physical regions of the integrated circuit;

     c) constructing a network flow model representing the movement of the cells between the physical regions;

     d) solving the network flow model to determine a desired flow of the cells between the physical regions of the integrated circuit; and

     e) realizing the best approximation of the desired flow of cells.

2. The method as recited in claim 1, wherein in step b) the physical regions defined in the image space capture a two-dimensional distribution of the free-space, blockage space and placement of the cells.

3. The method as recited in claim 1, wherein in step b) the physical regions defined in the image space are placement-aware to facilitate physically realizable global solutions and avoid unnecessary movement of the cells across the physical regions.

4. The method as recited in claim 1, wherein in step c) the network flow model represents a required global area migration across the image space to satisfy area capacity-demand constraints.

5. The method as recited in claim 1, wherein in step c) the network flow model captures a two-dimensional movement of the cells between the physical regions.

6. The method as recited in claim 1, wherein step e) further comprises the steps of:

(e1) selecting the cells from each physical region to satisfy the desired flows in each direction with a minimum cost;

(e2) physically moving the cells between the physical regions; and

(e3) updating the desired flows locally based on an unrealized flow value.

7. The method as recited in claim 6, wherein in step e1) the selection of cells from each physical region is modeled as a generalized network flow model.

8. The method as recited in claim 6, wherein in step e1) the cells to be moved from one physical region to all neighboring regions based on the desired flow directions are selected simultaneously to minimize the total cost.

9. The method as recited in claim 6, wherein in step e1) an approximation algorithm is provided for selecting the cells from one physical region to be moved with minimum cost.

10. The method as recited in claim 6, wherein in step e1) the cost of the cell movements is computed by executing a method selected from the group consisting of: quadratic movement cost, linear movement cost, timing sensitivity or criticality, linear wirelength change and pin congestion measure.

11. The method as recited in claim 6, wherein in step e2) the cells are moved to target regions while determining a detailed physical location of the cells that are moved.

12. The method as recited in claim 11, wherein the cells are placed at the closest physical location in the target region from the original region using ripple-slide operation to resolve local overlaps resulting thereof.

13. The method as recited in claim 6, wherein in step e2) the regions are dynamically resized to accommodate the horizontal movement of the cells.

14. The method as recited in claim 6, wherein in step e3) the desired flows from the target regions are locally updated to account for excess assignments resulting from discrete cell sizes.

15. The method as recited in claim 1, further comprising the steps of

(f) updating the global network model by iterating steps (d) and (e) to converge to a solution that satisfies all capacity-demand constraints.

(g) providing a local re-ordering of the cells to minimize a linear wirelength metric; and

(h) approximately modeling the movement of multi-row high cells using an augmented network flow model.

16. The method as recited in claim 15, wherein in step g) the new position of the cells is achieved by swapping cells within a local region to minimize the linear wirelength.

17. The method as recited in claim 15, wherein in step h) the augmented network flow graph approximately models the presence and the movement of multi-row high cells along with single-row high cells.

18. The method as recited in step h) of claim 15, further comprising the steps of:

h1) solving the global augmented network model to include multi-row high cells;

h2) pre-placing multi-row high cells at a an initial location based on a global solution; and

h3) executing steps (b) through (e) to legalize the single-row high cells.

19. The method as recited in claim 15, wherein in step e1) the cost of cell movement in the general framework is computed by executing a method selected from the group consisting of: quadratic movement cost, linear movement cost, timing sensitivity or criticality, linear wirelength change and pin congestion measure.

20. A program storage device readable by a machine, tangibly, embodying a program of instructions executable by the machine to perform method steps for performing static timing analysis of a digital system in the presence of a plurality of global sources of delay variation, said method steps comprising:

a) determining an initial placement of the cells;

b) capturing the placement-view including blockage-space and free-space to define in an image space physical regions of the integrated circuit;

c) constructing a network flow model representing the movement of the cells between the physical regions;

d) solving the network flow model to determine a desired flow of the cells between the physical regions of the integrated circuit; and

e) realizing the best approximation of the desired flow of cells